Lesson Plan Session 2

Working with GeoGebra Practical Session

General aspects:

1. *Learning Goals:*

To develop an understanding of the use of GeoGebra in mathematics teaching

To develop problem solving skills using GeoGebra as a technological tool

To develop problem posing skills using photos in GeoGebra.

2. *General strategy:*

Working practically in GeoGebra in pairs and/or groups, alongside discussing the use of technology

3. *Structure*

Lesson segments: working with photos, logging in to the GeoGebra materials on the website, logging in to a GGb group and sharing materials.

4. *Resources:*

PowerPoint presentation, folder with photos, camera/smartphone

Development of the Lesson:

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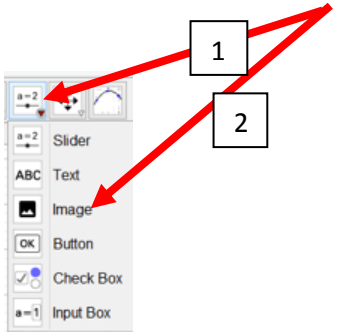
Task and Learning Activities	Expected Duration	Class Activity (potential difficulties)	Instructor Support	Goal and Assessment
Introduction	5 mins	Present a folder with photos available if the participants are not able to go and find good motives themselves.		*Goal:* To make the students confident with finding photos in a folder *Assessment:* Ask the students in class or in groups if they are confident.
Showing how to import photos into the graphics  	10 mins	Present the icon that you need when you want to import photos into the graphics. Investigate how it works and discover the possibilities. The points in the edges of the picture (they come automatically with the photo in the graphics) can be drawn to make the picture bigger or smaller.	It is nice if the students have access to a camera (smart phone) and are able to upload pictures from the phone to a folder on the pc/mac. If the students are working on a tablet, they automatically have access to the photos taken with the tablet.	*Goal:* To make the students able to import images to the graphics *Assessment:* let the students explain to a partner how the icons in GGb works

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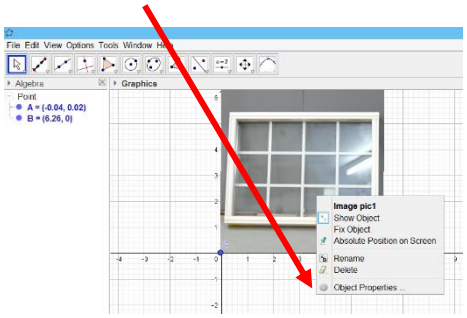
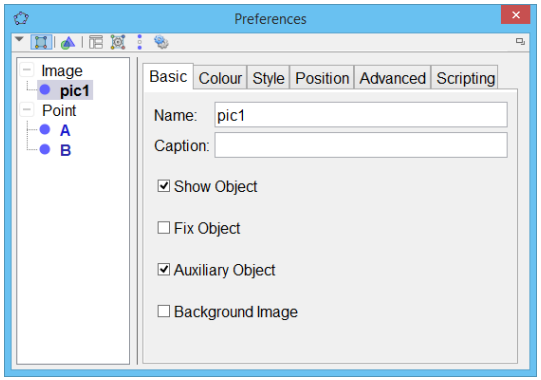
Import photos to investigate patterns, symmetry and other geometric properties. The students are asked to change opacity in the picture, which makes it possible to see everything on top of and behind the picture. This is possible when making a right click on the mouse and choose object properties:  In object properties you will meet a new menu:  Here you choose colour, and get this:	15 mins	If the students reflect on the angles in the photo - talk to them about what might have happened, because the real window has right angles.	Be sure that everybody knows, can explain and are able to use different geometric properties.	*Goal:* To make the students investigate different photos and find different geometric properties. They also have to explain, how they found the properties and what is special about them. Posing problems to each other using photos could also be an issue. *Assessment:* Have the students produce screencasts of their investigations and share these with the rest of the group/class.

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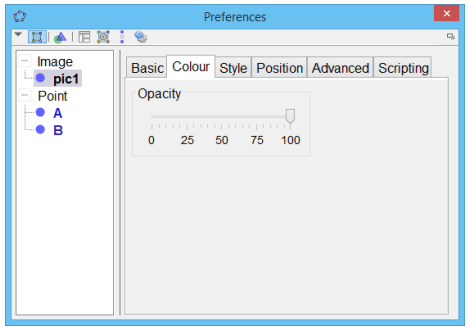
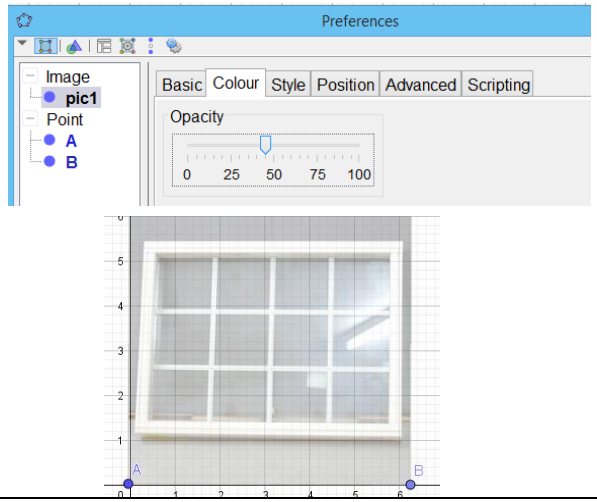


Then you move the slider and watch how the photo changes:



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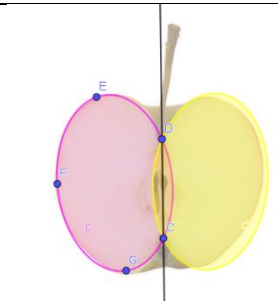
The students draw upon the photos using different shapes, lines and other possible icons from GGb. Here is an example: A photo of an apple cut through - is it symmetric?		30 mins	The students choose two or three photos that they want to investigate. They need to try different figures/icons in GGb to see which one fits their picture as good as possible. The students should find other geometric properties than symmetry - maybe they can find a hidden calculation in the photo or ask a friend if he/she can make up some calculations that equals the number of figures that are in his/her photo. (The window above could be an example of this). Summarize on the findings	Make space for every trial and have the students sharing their pictures and findings with GGb in a Padlet (or something else that can collect their work) Let the students formulate questions/problems connected to the photos and findings. If they are working in pairs, they can pose questions to each other and comment each other's findings - maybe new ideas will occur.	*Goal:* To give the students opportunity to discover different geometric properties using the different possibilities in GGb. To have the students reason about more geometric properties - e.g. that if you reflect a figure twice it is possible to make a parallel translation (or translation by vector) to create the exact same movement. *Assessment:* Have the students collect their pictures in a padlet or a GGb-group, to give everybody the possibility to see and give feedback to each other.

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